

WHAT IS CLAIMED IS:

1. A method of forming a copper wiring in a semiconductor device, comprising the steps of:

5 forming a first interlayer insulating film and an anti-polishing layer on a substrate;

etching the anti-polishing layer and the first interlayer insulating film to form a damascene pattern;

forming a copper anti-diffusion conductive film and a copper layer on the anti-polishing layer including the damascene pattern;

10 forming a copper wiring within the damascene pattern;

forming a metal element doping layer on the surface of the entire structure including the copper wiring; and

forming a copper anti-diffusion insulating film and a second interlayer insulating film on the entire structure on which the metal element doping layer is formed, wherein a copper alloy layer and a metal oxide layer are formed at the interface of the copper wiring and the copper anti-diffusion insulating film due to heat upon depositing the insulating film, and the metal oxide layer is formed at the interface of layers around the copper wiring and the copper anti-diffusion insulating film.

20

2. The method of claim 1, wherein the metal element doping layer is formed by doping a specific metal element by means of an implantation method or a plasma doping method, and the copper alloy layer is formed to

have a thickness in the range of 10 Å to 500 Å, by controlling a depth and a concentration.

3. The method of claim 2, wherein the metal element doping layer is
5 formed so that the concentration of the specific metal element is in the range of 0.5% to 10%.

4. The method of claim 2, wherein the specific metal element is a
metal element such as Mg, Cd, Be, Sn and Pd.
10

5. The method of claim 1, wherein the metal element doping layer is
formed so that a concentration of a specific metal element is in the range of
0.5% to 10%.

15 6. The method of claim 1, wherein in order to remove a copper oxide
layer generated on the surface of the copper wiring, a plasma treatment is
performed in one of a process before the metal element doping layer is formed,
a process in which the metal element doping layer is formed and a process
after the metal element doping layer is formed.

20

7. The method of claim 6, wherein the plasma treatment is performed
using a mixed gas of nitrogen and hydrogen or an ammonia series gas at a
temperature in the range of 100 °C to 350 °C.

8. The method of claim 1, wherein after the second interlayer insulating film is formed, an annealing process for forming the copper alloy layer and the metal oxide layer is performed.

- 5 9. The method of claim 8, wherein the annealing process is performed at a temperature in the range of 100 °C to 500 °C.